



Defragmentation of journals enhances access and collaboration: commentary on the occasion of *Zootaxa* 4,000

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Scientific literature in all fields of science are fragmented over many journals and other publications. This is mainly due to the diversity in scientific disciplines and publishers around the world. Databases, abstracting/indexing publications and review journals have helped defragment widely dispersed publications. With the rapid development and wider availability of the internet in the last two decades, many traditional paper-based journals have become online, along with the development of online-only journals. A new form of defragmentation (the development of mega-journals) emerged and *Zootaxa* was at its forefront (Zhang 2006b). On the occasion of *Zootaxa* 4,000, I herein discuss the mega-journals, defragmentation in scientific publications in general, and the development and achievements of *Zootaxa* in biodiversity sciences.

Mega-journals and defragmentation in the publishing landscape

Mega-journals are clearly recent developments. Björk (2015) claimed that “It is unclear to this author who first coined the phrase mega-journal” and quoted Wikipedia (https://en.wikipedia.org/wiki/Mega_journal): “A mega journal is a peer-reviewed academic open access journal designed to be much larger than a traditional journal by exerting low selectivity among accepted articles”. This article by Wikipedia (last accessed on 18 August 2015 with a notice “this page was last modified on 29 July 2015, at 09:23.”) listed 23 references, including Zhang (2006b) “The making of a mega-journal in taxonomy”, which was published much earlier than other dated references (2011–2014) cited by Wikipedia.

Zhang (2006b) defined mega-journal and showed that *Zootaxa* was a mega-journal already in 2006 by the following criteria: (1) A mega-journal must be a magnitude larger than an average journal in a particular field; (2) A mega-journal should represent and involve the majority of scientists working in the discipline; and (3) A mega-journal should publish a significant number of the most important works in the subject area. This definition is similar to that of Björk’s (2015) and those that can be found in other un-refereed grey literature in that a mega-journal should be much larger than other journals. However, it also provides more clearly quantifiable criteria; it does not require open access nor low selectivity in peer review; emphasizes greater participation of scientists currently working in the discipline; and publishes a significant number of the most important works in the subject area.

Zhang (2006b) noted “One major benefit of *Zootaxa* is the concentration of a vast body of papers in a single easy access journal that otherwise would be scattered in hundreds of small journals, many of which are expensive, difficult to access, and/or are only available in large research libraries in developed countries. The new model presented by *Zootaxa* is nothing short of revolutionary.” Smith (2010) commented: “*Zootaxa* has helped defragment the publishing landscape for zoological taxonomy, making taxonomy findable, and enabling the discipline to benefit from the network effects of increased collaboration.” In essence, the main benefits of mega-journals are both defragmentation in publications and networking among scientists. The latter is especially important for the progress of science. The innovation of publishing models with unlimited papers per year and the large community of *Zootaxa*’s subject editors helped its rapid rise in zoology; this occurred several years before the rise of *PLOS ONE* in multidisciplinary sciences (Table 1).

TABLE 1. Defragmentation of publications as measured by domination of the top journal in *Journal Citation Reports (JCR)* 2006 to 2014 editions: comparison between *JCR* categories “multidisciplinary sciences” and “zoology”, with the former much broader in scope than the latter (this enables the top journal in the former category to attract more papers and thus higher percentage than the latter). *PNAS* = *Proceedings of the National Academy of Sciences of the United States of America*.

	% of papers in the top journal of the total in the category (the name of the top journal)								
	2006	2007	2008	2009	2010	2011	2012	2013	2014
Multidisciplinary Sciences	33.6% (<i>PNAS</i>)	32.8% (<i>PNAS</i>)	34.4% (<i>PNAS</i>)	34.1% (<i>PNAS</i>)	30.6% (<i>PNAS</i>)	33.6% (<i>PNAS</i>)	63.6% (<i>PLOS ONE</i>)*	65.4% (<i>PLOS ONE</i>)	61.4% (<i>PLOS ONE</i>)
Zoology	12.8% (<i>Zootaxa</i> **)	12.5% (<i>Zootaxa</i>)	12.1% (<i>Zootaxa</i>)	14.8% (<i>Zootaxa</i>)	14.6% (<i>Zootaxa</i>)	14.2% (<i>Zootaxa</i>)	15.6% (<i>Zootaxa</i>)	16.9% (<i>Zootaxa</i>)	16.4% (<i>Zootaxa</i>)

* The first listing in *JCR* in 2012 (founded in 2006).

** The first listing in *JCR* in 2006 (founded in 2001).

The development and achievements of *Zootaxa*

Zootaxa started on 28 May 2001. I published several editorials summarizing its history and achievements in the past, the last one being Zhang (2014). Major milestones are listed in Table 2 and numbers of papers and pages published in *Zootaxa* from 2001 to 2014 are summarized in Figure 1.

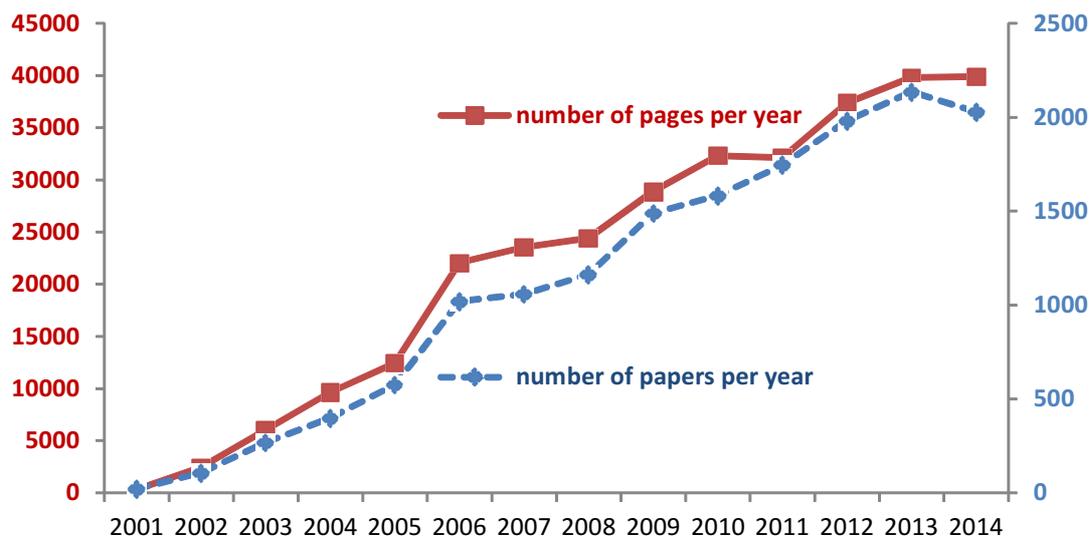


FIGURE 1. The numbers of papers and pages published in *Zootaxa* from 2001 to 2014.

Upon the completion of *Zootaxa* 4,000, over 16,990 papers (including over 980 monographs) have been published in over 339,600 pages. *Zootaxa* continues to grow in recent years despite its very large volume (Fig. 1). It published over 1,400 papers (including 63 books/monographs) in over 28,300 pages in 2015 already; with a third of the year still to go, it is expected that there will be about 2,100 papers in some 42,000 pages in 2015.

Zootaxa's greatest achievements have been its leadership position in describing the world's undiscovered biodiversity. In 2010, *Zootaxa* published about 20% of all new taxa indexed in the *Zoological Record* (Zhang 2011a, b). From 2010 onwards, *Zootaxa* accounted for 25% of new taxa and other new nomenclatural acts in the *Zoological Record* (<http://www.organismnames.com/metrics.htm?page=tsj>; last accessed on 18 Aug. 2015).

TABLE 2. Milestones in the development and growth of *Zootaxa*. Date in the format of year, month and day.

Date	Milestones	References
2001.05.28	The beginning: <i>Zootaxa</i> 1 published.	Moraes & Freire (2001)
2003.12.23	The number of authors reached 500	Zhang (2010)
2005.01.27	The number of authors reached 1,000	Zhang (2010)
2005.05.27	Four years old: <i>Zootaxa</i> 1,000 published. Over 23,000 pages in 1,000 papers by 1,100 authors.	Rodiles-Hernández <i>et al.</i> (2005) Zhang (2005)
2005.05.28	The first change in issuing: papers <60 pages were no longer separately issued and bound as before in <i>Zootaxa</i> 1–1,000; new categories of short items of < 4 pages (e.g. editorial or short correspondence) were acceptable.	Zhang (2005)
2005.12.22	<i>Zootaxa</i> published 1,103 issues in 31,038 pages with 2,337 new taxa by 1,619 authors.	Zhang (2006a)
2006.05.15	The number of authors exceeded 2,000.	Zhang (2010)
2007.04.09	The number of authors exceeded 3,000.	Zhang (2010)
2007.12.21	Special volume: "Linnaeus Tercentenary" published.	Zhang & Shear (2007)
2008.01.01	The first paper in zoology registered in ZooBank: the beginning of cybertaxonomic revolution in zoology	Pyle <i>et al.</i> (2008); Zhang (2008b)
2008.08.01	A Featured Journal from Essential Science Indicators SM	Zhang (2008a)
2008.01.14	The number of authors exceeded 4,000.	Zhang (2010)
2008.11.12	The number of authors exceeded 5,000.	Zhang (2010)
2008.12.22	The number of pages exceeded 100,000.	Zhang (2008a)
2009.05.28	Eight years old: daily publication began.	Zhang (2009)
2009.11.14	<i>Zootaxa</i> 2,000 published.	Zeidler (2009)
2011.08.22	<i>Zootaxa</i> 3,000 published.	Reid & Beatson (2011)
2011.12.23	Special volume: "Animal Biodiversity" published. The number of authors reached 9,479	Zhang (2011c)
2012.09.04	ICZN Amendment of the International Code of Zoological Nomenclature to allow e-publications. <i>Zootaxa</i> online version the first to be valid.	International Commission on Zoological Nomenclature (2012); Zhang (2012)
2013.01.03	The second change in issuing starting from <i>Zootaxa</i> 3599; the online issue is the version of record, published before the print edition and deposited with migration to PDF/A in Biotaxa.org portal, with <i>Zootaxa</i> as a founding journal.	Zhang (2014)
2015.08.19	All issues of <i>Zootaxa</i> 4,000 published.	This paper

As a model, *Zootaxa* has inspired a new generation of journals in taxonomy. Two of these are very large and helped in the defragmentation of taxonomic publications. *Phytotaxa* is now the second largest journal in taxonomy and the largest in botany (Zhang *et al.* 2014). *ZooKeys* is now the second largest journal in zoology (Erwin *et al.* 2015).

In 2012, *Zootaxa*, in collaboration with other institutions and journals (natural history museums, societies, publishers etc), took a leading role in developing a non-profit international facility that will integrate cost-efficient online publishing and permanent digital archiving for all taxonomic publications (Biotaxa.org). This initiative was first discussed in Zhang (2011a) briefly and more in Zhang (2014). It is estimated that over 30% of new species in 2014 were published in papers archived in Biotaxa—a new level in the defragmentation of taxonomic publications.

Editors and their contributions (2014)

The active participation of taxonomists as authors, reviewers and editors is one of the keys to the success of *Zootaxa*, which creates a community that can facilitate and also benefit from increased collaboration (Zhang 2008a, 2010; Smith 2010). Expert editors, in particular, provide leadership roles in the development of the journal and quality control; the latter is especially important for the success of the journal and development of our science.

During 2014, an expert team of 221 active editors accepted 1,972 papers or monographs, or an average of 9 papers per editor. The distribution of papers accepted by various editors is highly uneven (Table 3), as reported before for papers published in 2007 and 2013 (Zhang 2014). Most editors (72%) accepted 10 or few papers during 2014. Only the top 10% of the editors accepted more than 20 papers per year, but they together accepted over 1/3 of the total during the year. Dr Jan Klimaszewski (Coleoptera, Canada) is the top editor in 2014 (52 accepted manuscripts or just over 2 per week). Seven of the top 10 editors (*i.e.*, Klimaszewski, Rentz, Dietrich, Jennings, Carranza, Rasmussen, Castro) were also among the top 10 editors of papers published in 2013 (Table 3; Zhang 2014).

TABLE 3. *Zootaxa* editors and their contributions in terms of number of papers accepted in 2014.

Number of accepted paper per editor	Number of editors per category	Names of editors (number of accepted papers)
51–55	1	Klimaszewski, Jan (52)
46–50	1	Rentz, David (50)
41–45	3	Goy, Joseph (44); Dietrich, Chris (43); Jennings, John T. (42)
36–40	1	Carranza, Salvador (37)
31–35	2	Rasmussen, Claus (32); Castro, Peter (31)
26–30	5	Malipatil, Mallik (28); Rider, David (28); Holleman, Wouter (27); Seeman, Owen (27); Paulson, Dennis (26)
21–25	10	Carvalho, Marcelo R. de (25); Vences, Miguel (25); Gaimari, Steve (24); Lelej, Arkadiy S. (24); Anderson, Robert (23); Landry, J-F. (23); Ah Yong, Shane T. (22); Bauer, Aaron (21); Halliday, Bruce (21); Kondratieff, Boris (21)
16–20	13	Bochkov, Andrey (19); Pellinen, Markku (19); Schaefer, Carl (19); Bickel, Daniel (18); Karaman, G.S. (18); Prieto, Carlos (18); Shear, William (18); Evenhuis, Neal (17); Morse, John (17); Mound, Laurence (17); Pethiyagoda, Rohan (17); Schöller, Matthias (17); Hernandez-Triana, Luis (16)
11–15	31	Alonso, Miguel (15); Choudhury, Anindo (15); Gibson, Gary (15); Lowry, Jim (15); Mullin, Peter (15); Sinclair, Bradley (15); Smith, Andrew B.T. (15); Vink, Cor (15); Davies, Kerrie (14); Hodgson, Chris (14); Sidorchuk, Ekaterina (14); Gordon, Dennis (13); Rivera, J. (13); Sterrer, W. (13); Wang, Qiao (13); Borkent, Christopher (12); Cavalleri, Adriano (12); Dronen, Norman Jr (12); Hooper, John (12); Nagy, Zoltan (12); Price, Benjamin (12); Svenson, G.J. (12); Hutchings, Pat (11); Jacobus, Luke (11); Kehlmaier, Christian (11); Weiner, Wanda Maria (11)
6–10	55	*
1–5	104	*

* Those editors who accepted 10 or fewer papers in 2014 are too numerous and not individually listed.

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